Idaho National Engineering Laboratory

IDAHO DEPARTMENT OF HEALTH AND WELFARE
DIVISION OF ENVIRONMENTAL QUALITY

Record of Decision

Naval Reactors Facility

Industrial Waste Ditch and Landfill Areas

Operable Units 8-07, 8-06 and 8-05

Idaho National Engineering Laboratory

Idaho Falls, Idaho

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DECLARATION OF THE RECORD OF DECISION

SITE NAME AND LOCATION

Naval Reactors Facility Industrial Waste Ditch and Landfill Areas
Operable Units 8-07, 8-06, and 8-05
Idaho National Engineering Laboratory
Idaho Falls, Idaho

STATEMENT OF BASIS AND PURPOSE

This document presents the remedial actions selected for the Naval Reactors Facility Industrial Waste Ditch (Operable Unit 8-07) and Landfill Areas (Operable Units 8-05 and 8-06) at the Idaho National Engineering Laboratory. The remedy was selected in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act, as amended by the Superfund Amendments and Reauthorization Act, and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan. This decision was based on the information in the Administrative Record for the Naval Reactors Facility Industrial Waste Ditch and Landfill Areas.

The U.S. Environmental Protection Agency (EPA) approves of this remedy, and the State of Idaho concurs with the selected remedial actions.

ASSESSMENT OF THE SITE

The Naval Reactors Facility Industrial Waste Ditch and Landfill sites 8-05-59, 8-06-35, 8-06-36, 8-06-48, 8-06-49, and 8-06-50 do not present an unacceptable risk to human health or the environment, and therefore, require no further action. Hazardous substances disposed of in landfill areas 8-05-1, 8-05-51, and 8-06-53 may present a potential threat to public health or welfare, or to the environment if not addressed by implementing the response action selected in this Record of Decision.

DESCRIPTION OF THE SELECTED REMEDY

The Naval Reactors Facility has been designated as Waste Area Group (WAG) 8 of the 10 WAGs at the INEL which are under investigation pursuant to the Federal Facility Agreement and Consent Order (FFA/CO) between the Idaho Department of Health and Welfare (IDHW), the EPA, and the U.S. Department of Energy (DOE). The Industrial Waste Ditch is designated as Operable Unit 8-07, and the Landfill Areas are designated as Operable Units 8-05 and 8-06. No action is recommended for the Industrial Waste Ditch or Landfill Units 8-05-59, 8-06-35, 8-06-36, 8-06-48, 8-06-49, and 8-06-50. The recommended remedial action for landfill sites 8-05-1, 8-05-51, and 8-06-53 is in accordance with the Presumptive Remedy for CERCLA Municipal Landfill Sites. This consists of containment of landfill contents and soil gas monitoring to reduce the risks associated with potential exposure to the contaminated wastes. Ground water monitoring will be performed to provide information on the impact these areas may have had on ground water and to support the NRF Comprehensive Record of Decision.

The major components of the selected remedy include:

Installation of a native soil cover, followed by planting with native vegetation to reduce erosion;

Periodic inspection and maintenance to ensure the integrity of the cover;

Soil gas monitoring to provide early detection of any release from the landfill areas to the subsurface, ground water, or surface pathways;

Ground water monitoring to evaluate these and other areas at NRF; and

Maintaining institutional controls, including signs, postings, and land use restrictions.

STATUTORY DETERMINATION

The selected remedy is protective of human health and the environment, complies with Federal and State applicable or relevant and appropriate requirements, and is cost effective. This remedy utilizes permanent solutions and presumptive remedies to the maximum extent practicable; however, because the wastes can be reliably controlled in place, treatment of the principle sources of contamination was not found to be cost effective. Therefore, this remedy does not satisfy the statutory preference for treatment as a principal element of the remedy.

Because the remedy will result in hazardous substances remaining in some of the landfill areas onsite, a review will be conducted within five years after commencement of remedial actions, and every five years thereafter, to ensure that the remedy continues to provide adequate protection of human health and the environment.

SIGNATURE SHEET

Signature sheet for the foregoing Industrial Waste Ditch and Landfill Areas of Naval Reactors Facility at the Idaho National Engineering Laboratory Record of Decision between the U.S. Department of Energy and the Environmental Protection Agency with concurrence by the Idaho Department of Health and Welfare.

Jane J Moore — 9-27-94

for CHUCK CLARKE — Date

Regional Administrator, Region 10

U.S. Environmental Protection Agency

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SIGNATURE SHEET

Signature sheet for the foregoing Industrial Waste Ditch and Landfill Areas of Naval Reactors Facility at the Idaho National Engineering Laboratory Record of Decision between the U.S. Department of Energy and the Environmental Protection Agency with concurrence by the Idaho Department of Health and Welfare.

Theron M Bradley Jr. — Sept 28, 1994

THERON M. BRADLEY — Date
Manager
U.S. Department of Energy Naval Reactors Idaho Branch

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SIGNATURE SHEET

Signature sheet for the foregoing Industrial Waste Ditch and Landfill Areas of Naval Reactors Facility at the Idaho National Engineering Laboratory Record of Decision between the U.S. Department of Energy and the Environmental Protection Agency with concurrence by the Idaho Department of Health and Welfare.

Jerry L. Harris — 9/30/94

JERRY L. HARRIS
Director
Idaho Department of Health and Welfare

Date

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TABLES

FIGURES

ACRONYMS

A1W	Large Ship Reactor Prototype
ARAR	Applicable or Relevant and Appropriate Requirements
ASTM	American Society for Testing and Materials
BTEX	Benzene, toluene, ethylbenzene, and total xylenes
BGS	Below Ground Surface
BESWL	Below Elevation of the Static Water Level
BLM	Bureau of Land Management
BTEX	Benzene, toluene, ethylbenzene, and total xylene
CEC	Cation Exchange Capacity
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFA	Central Facilities Area
CFR	Code of Federal Regulations
CLP	Contract Laboratory Program
COCA	Consent Order and Compliance Agreement
CRP	Community Relations Plan
CSM	Conceptual Site Model
DOE	Department of Energy
DOE-ID	Department of Energy, Idaho Field Office
EPA	Environmental Protection Agency
FFA/CO	Federal Facility Agreement/Consent Order
FS	Feasibility Study
GRA	General Response Action
HQ	Hazard Quotient
ICR	Increased Cancer Risk
IDHW	Idaho Department of Health and Welfare
IWD	Exterior Industrial Waste Ditch
INEL	Idaho National Engineering Laboratory
km	kilometer
MDL	Method Detection Limit
mi	miles
NCP	National Contingency Plan
NPL	National Priorities List
NRF	Naval Reactors Facility
OU	Operable Unit
PCB	Polychlorinated biphenyls
PCE	Tetrachloroethylene
ppb	parts per billion
PPE	Personal protective equipment
ppm	parts per million
PVC	Polyvinyl Chloride
QA/QC	Quality Assurance/Quality Control
RAGS	Risk Assessment Guidance for Superfund
RAO	Remedial Action Objective
RCRA	Resource Conservation and Recovery Act
RfD	Reference Dose
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
RPM	Remedial Project Manager

SARA	Superfund Amendments and Reauthorization Act of 1986
SRPA	Snake River Plain Aquifer
SOP	Standard Operating Procedure
SOW	Statement of Work
S1W	Submarine Thermal Reactor Prototype
SVOCs	Semi-Volatile Organic Compounds
TAN	Test Area North
TCA	1,1,1-trichloroethane
TCLP	Toxicity Characteristic Leaching Procedure
TPH	Total Petroleum Hydrocarbons
TSD	Treatment, Storage, and Disposal facility
USGS	United States Geological Survey
UTL	Upper tolerance limit
VOCs	Volatile Organic Compounds
WAG	Waste Area Group

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1. DECISION SUMMARY

Site Name, Location, and Description

The Idaho National Engineering Laboratory (INEL) is a government facility managed by the U.S. Department of Energy located 51.5 kilometers (km) [32 miles (mi)] west of Idaho Falls, Idaho, and occupies 2305 km^2 (890 mi^2) of the northeastern portion of the Eastern Snake River Plain. The Naval Reactors Facility is located on the west-central side of the Idaho National Engineering Laboratory (Figure 1). This Record of Decision applies only to that portion of the Industrial Waste Ditch outside the NRF perimeter (Operable Unit 8-07, hereinafter referred to the Industrial Waste Ditch). This segment extends about 3.2 miles to the northeast from the northwest corner of the fence. The interior portion of the ditch will be addressed as Operable Unit 8-09. The Landfill Units (Operable Units 8-06 and 8-05) include nine separate locations situated on the west and northeast sides of the facility. The maximum area of the combined landfill units is 0.16 km^2 (0.06 mi^2).

Current land use at the INEL is primarily dedicated to nuclear research and development, and waste management. Surrounding areas are managed by the Bureau of Land Management for multipurpose use. The developed area within the INEL is surrounded by a 1295 km^2 (500 mi^2) buffer zone used for cattle and sheep pasture.

Of the 11,700 people employed at the INEL, approximately 830 are employed at the Naval Reactors Facility. The nearest offsite populations are in Atomic City, Arco, Howe, Mud Lake, and Terreton.

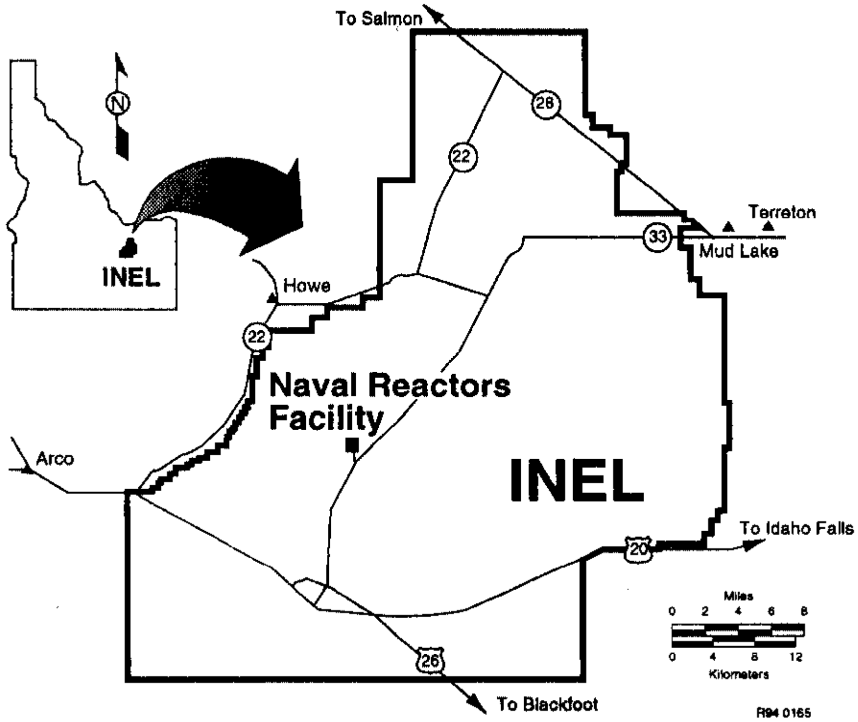

Figure 1 The Idaho National Engineering Laboratory showing the location of the Naval Reactors Facility.

The INEL is located on the northeastern portion of the Eastern Snake River Plain (ESRP), a volcanic plateau that is primarily composed of silicic and basaltic rocks and relatively minor amounts of sediment. Underlying the INEL are a series of basaltic flows with sedimentary interbeds. The basalts immediately beneath the Naval Reactors Facility are relatively flat, and are covered by 6.1 to 9.1 meters (20 to 30 feet) of alluvium and loess.

The depth to the Snake River Plain Aquifer (SRPA) at the INEL varies from 61 meters (200 feet) in the northern portion to 274.3 meters (900 feet) in the southern portion. The depth to the aquifer at the Naval Reactors Facility is approximately 112.78 meters (370 feet). Regional ground water flow is generally to the southwest.

The Idaho National Engineering Laboratory has semidesert characteristics with hot summers and cold winters. Normal annual precipitation is 23.1 centimeters (9.1 inches). The only surface water present at the INEL is the Big Lost River, which is approximately three miles south of the Naval Reactors Facility. However, this river is typically dry due to the arid climate. The only naturally occurring surface water at the Naval Reactors Facility results from heavy rainfall or snow melt, usually during the period from January to April.

Twenty distinctive vegetative cover types have been identified at the INEL, with big sagebrush being the dominant species, covering approximately 80% of the ground surface. The variety of habitats on the INEL support numerous species of reptiles, birds, and mammals. Several bird species warrant special concern because of sensitivity to disturbance or their threatened status. These species include the ferruginous hawk (*Buteo regalis*), bald eagle (*Haliaeetus leucocephalus*), prairie falcon (*Falco mexicanus*), merlin (*Falco columbarius*), long-billed curlew (*Numenius americanus*), and the burrowing owl (*Athlene cunicularia*). The ringneck snake, whose occurrence is considered to be INEL-wide, is listed by the Idaho Department of Fish and Game as a Category C sensitive species.

The areas of the Industrial Waste Ditch and landfill areas included within this Record of Decision have been evaluated for compliance with the Wetlands Protection Act, Flood Plain legislation, and Historical and Cultural Preservation, and were found to meet the applicable and relevant or appropriate statutes.

The Naval Reactors Facility includes approximately 80 developed acres. Nonradioactive, nonhazardous industrial waste water from water treatment operations and storm water runoff has been discharged to the IWD since 1953. The ditch was originally an old stream bed, and it has been modified to carry water away from the facility. The volume of water discharged has varied greatly, depending on operational requirements. Due to recent reductions in operations, water is rarely present beyond 1.2 miles beyond the outfall. When both the IWD and Landfill units are discussed in Sections 5 through 11 of this Record of Decision, the IWD will be discussed first, or will be labeled as subsection 'a'.

The landfill areas are primarily located west and northeast of the Naval Reactors Facility. Operable Units 8-05 and 8-06 include nine separate areas which have been identified as potential waste disposal sites. The wastes in these landfill areas are similar to those found in municipal landfills; cafeteria wastes, construction debris, petroleum products, paper, and small amounts of paints and solvents. Different landfill units were used at various times from 1951 through 1971. NRF discontinued use of the last landfill unit in 1971. When both the IWD and Landfill units are discussed in Sections 5 through 11 of this Record of Decision, the landfills will be discussed second, or will be labeled as subsection 'b'.

Assessment of the Industrial Waste Ditch

The no action decision is applicable to the Industrial Waste Ditch because there is no unacceptable risk to human or ecological receptors in the present or future land use scenarios.

Assessment of the Landfill Units

Landfill sites 8-05-59, 8-06-35, 8-06-36, 8-06-48, 8-06-49, and 8-06-50 were evaluated using existing data, and risk calculations were performed for those constituents identified by the soil gas analyses, surface soil samples, or based on historic information. These six areas were determined to contain primarily construction debris, did not present any unacceptable risk to human or environmental receptors, and are recommended for no action. Landfill sites 8-05-1, 8-05-51, and 8-06-53 have contents similar to those found in municipal landfills. As agreed to by the three parties, intrusive sampling of the actual contents of the landfills was not performed. Containment with a native soil cover is the recommended alternative for these areas, based on the Presumptive Remedy for Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Municipal Landfill Sites, to provide assurance that there will not be a release of contaminants to the environment in the future. Five year reviews will be conducted to verify that the actions taken remain protective of human health and the environment.

Description of the Selected Remedy

The alternative selected for landfill sites 8-05-1, 8-05-51, and 8-06-53 is the Presumptive Remedy for CERCLA Municipal Landfill Sites. Presumptive remedies are preferred technologies for common categories of sites, based on historical patterns of remedy selection and EPA's scientific and engineering evaluation of performance data on technology implementation. The objective of the presumptive remedies process is to use the EPA's past experience to streamline site investigation and the remedy selection process, thereby improving consistency, reducing cost, and increasing the speed with which hazardous waste sites are remediated. The specific actions are to survey and mark the areas, restrict land use by means of administrative controls, monitor soil gases, and install and maintain a two foot thick native soil cover over the landfill contents. Ground water monitoring will be performed to evaluate these and other areas at NRF.

2. SITE HISTORY AND ENFORCEMENT ACTIVITIES

The Naval Reactors Facility was established in 1949 as a testing site for the naval nuclear propulsion program. The Submarine Thermal Reactor Prototype (S1W) became operational in 1953. At that time, the first section of the Industrial Waste Ditch was constructed to accommodate the disposal of nonradioactive, nonsewage liquid discharges. The three landfill units received solid waste similar to that of municipal landfills (construction, petroleum, and cafeteria wastes, and small quantities of paint products) from the prototype and support facility operations.

The Large Ship Reactor Prototype (A1W) and the Expended Core Facility (ECF) became operational in 1958, and the S5G Prototype became operational in 1965. As the Naval Reactors Facility expanded, the Industrial Waste Ditch was modified to accommodate the increased volume of waste water. The primary discharge constituents were nonradioactive cooling water, acidic and basic solutions from the water treatment facility, facility discharges with occasional oily residues, storm water runoff, and small amounts of laboratory chemicals.

The landfill areas were used intermittently from the time construction started at NRF. In general, construction debris and waste material was burned, then covered with soil. The volume of construction debris decreased after the construction of A1W and ECF in 1958, and after the construction of S5G in 1965. Use of the last NRF landfill ceased by 1971.

In 1980, the Naval Reactors Facility ceased the discharge of all Resource Conservation and Recovery Act (RCRA) wastes to the Industrial Waste Ditch with the exception of the acidic and basic ion exchange regenerant solutions, which were self-neutralizing. In 1985, a facility was constructed to neutralize these solutions prior to discharge. A Consent Order and Compliance Agreement (COCA) was established between the Department of Energy and the U.S. Environmental Protection Agency pursuant to the Resource Conservation and Recovery Act Section 3008(h) in August 1987. The COCA required an initial assessment and screening of all solid waste and/or hazardous waste disposal units at the INEL, and set up a process for conducting any necessary corrective actions. In November 1989, the INEL was listed on the National Priorities List (NPL) by the EPA under CERCLA as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA). The DOE, EPA, and State of Idaho Department of Health and Welfare (IDHW) entered into the Federal Facility Agreement and Consent Order (FFA/CO) on December 9, 1991.

Most of the discharge to the IWD has been directly proportional to plant operations, particularly the amount of cooling water utilized. The reduction in work scope at the Naval Reactors Facility over the past five years has resulted in a corresponding decrease in the volume of water discharged to the IWD. When three prototype plants were operational, water was present to the 4 kilometer (2.5 mile) mark in the ditch channel. As a result of the inactivation of the S1W prototype in 1989 and the permanent shut down of the A1W prototype in 1994, water is only present in the first 1.6 kilometer (one mile) of channel. The S5G prototype inactivation scheduled to start in 1995 will further reduce the volume of water discharged to the IWD.

The IWD was identified for a Remedial Investigation/Feasibility Study (RI/FS) under the FFA/CO. The Landfill Units were investigated in accordance with Track 2 Sites: Guidance for Assessing Low Probability Hazard Sites at the INEL. The entire NRF area will be evaluated in the Waste Area Group (WAG) 8 Comprehensive RI/FS, which is scheduled to begin in 1995.

3. HIGHLIGHTS OF COMMUNITY PARTICIPATION

In accordance with CERCLA § 113(k)(2)(B)(i-v), information on the investigations and decision-making processes involved in the evaluation of the NRF Industrial Waste Ditch and Landfill Areas was provided to the public from January through April 1994 through fact sheet mailings, articles in the *INEL Reporter*, and public meetings. Opportunities to comment on these plans were provided during the public comment period from April 12 until May 12, 1994. A Fact Sheet and Proposed Plan were distributed to 7500 citizens by mail, telephone calls were made, and announcements were made in the media and INEL publications. Public information and scoping meetings and two open houses were also conducted. Both oral and written comments were accepted.

Display ads describing upcoming meetings were published in the following newspapers: Idaho Falls *Post Register*; Pocatello *Idaho State Journal*; Burley *South Idaho Press*; Twin Falls

Times News; Boise *Idaho Statesman*; Nampa *Idaho Press Tribune*; Lewiston *Morning Tribune*; and Moscow *Idahonian* between March 15 - 23, 1994 to encourage citizens to attend the public meetings and provide oral or written comments. During the week of March 27, 1994, a press release addressing the Naval Reactors Facility public meetings and general information on the investigations was released to approximately 40 media centers for dissemination to the public. Articles were also published in the *INEL Reporter*, *The INEL Citizens Guide to Environmental Restoration at the INEL*, and the *INEL News*.

Newspaper and radio advertisements were presented the week of April 10, 1994 to notify the public of the information sessions at Pocatello and Twin Falls. Advertisements were placed in two local newspapers, and radio advertisements were broadcast by six local stations five times a day for three days in Pocatello, Burley and Twin Falls. Two radio talk shows broadcast from Burley on April 13, 1994 and Jerome on April 14, 1994 provided information on the public meetings, and the locations of the INEL regional office. All media (letter, news release, radio, and newspaper ads) gave public notice of two scoping meetings and notification of the beginning of the 30 day public comment period from April 12 - May 12, 1994.

Personal phone calls concerning the availability of Naval Reactors Facility documents and public meetings were made to individuals, environmental groups, and organizations by INEL Outreach Office staff in Pocatello, Twin Falls, and Boise. The Community Relations Plan Coordinator made calls in Idaho Falls and Moscow.

Information sessions were held at the Pine Ridge Mall in Pocatello on April 12, 1994, and at the INEL regional office in Twin Falls on April 14, 1994 prior to the public meetings. On April 13, 1994, representatives from the DOE, EPA, and IDHW conducted a technical briefing via teleconference calls with members of the League of Women Voters and the Environmental Defense Institute in Moscow, Idaho.

All media presentations gave public notice that Naval Reactors Facility documents would be available before the beginning of the comment period in the Administrative Record section of the INEL Information Repositories located in the INEL Technical Library in Idaho Falls, as well as in the city libraries in Idaho Falls, Pocatello, Twin Falls, Boise, and Moscow. Display ads announced the same information.

Open houses were held in Pocatello on April 12, 1994 and Twin Falls on April 14, 1994. Public meetings were held in Idaho Falls on April 19, 1994, Boise on April 20, 1994, and Moscow on April 21, 1994. A total of 83 people attended these meetings. Written comment forms were available at all meetings. The reverse side of the meeting agenda provided a form for the public to evaluate the effectiveness of the meetings. A court reporter was present at each meeting to keep a verbatim transcript of discussions and public comments. The meeting transcripts were placed in the Administrative Record section for the Naval Reactors Facility Industrial Waste Ditch (Operable Unit 8-07), and Landfill Areas (Operable Units 8-05 and 8-06) in eight INEL Information Repositories.

A Responsiveness Summary has been prepared as part of this Record of Decision. All formal oral comments made at the public meetings, and all written comments are repeated verbatim in the Administrative Record. Those comments are annotated to indicate which response in the Responsiveness Summary addresses each comment.

A total of nine written comments and six oral comments were received during the comment period. All comments received on the Proposed Plan were considered during development of the Record of Decision. The decision for this action is based on the information in the Administrative Record for these Operable Units.

4. SCOPE AND ROLE OF OPERABLE UNITS AND RESPONSE ACTIONS

Under the FFA/CO, the INEL is divided into ten WAGs. The WAGs are further divided into Operable Units (OUs). The Naval Reactors Facility is designated as WAG 8, and consists of nine OUs. Monitoring data, process knowledge, written correspondence, and interviews with current and previous employees were used to evaluate the IWD and Landfill Units. The Remedial Investigation/Feasibility Study on the Industrial Waste Ditch and the Track 2 Investigations of the Landfill Areas evaluated the potential for contamination and migration from the soil, water, and air affected by these areas. A complete evaluation of all cumulative risks associated with the CERCLA actions at WAG 8 will be conducted as part of the NRF Comprehensive RI/FS to ensure that all risks have been adequately evaluated. This Record of Decision is part of the overall WAG strategy, and is expected to be consistent with any planned future actions.

Figure 2 Photograph of NRF with the IWD Extending Northeast from the Northwest Corner

5. SUMMARY OF SITE CHARACTERISTICS

Industrial Waste Ditch

The exterior portion of the NRF IWD (Operable Unit 8-07) extends about 5.15 kilometers (3.2 miles) to the northeast from the northwest corner of the fenced perimeter of the Naval Reactors Facility. The Industrial Waste Ditch was first used to dispose of nonradioactive, nonsewage industrial waste water in 1953. The primary component of the discharge stream throughout the lifetime of the IWD has been cooling water from circulating water systems, and ion exchange regenerant solutions. The ditch channel was modified around 1958 to direct the original waste stream and additional discharge from the newly constructed A1W plant toward the dry streambed at the northwest corner of the facility. In 1965, the channel was expanded to the point 2.66 kilometers (1.65 miles) downstream from the outfall to accommodate additional effluent as the S5G prototype became operational. After 1965, the ditch was dredged occasionally to improve drainage, but remained within the same channel. The dredged sediments were placed along the ditch banks parallel to the channel.

Table 5-1 identifies various categories of chemicals used at the NRF during historical operations, and provides an estimate of the source volume which may have been discharged to the IWD. It is uncertain if all the listed compounds entered the ditch network. This information is based on procurement records, process knowledge, and plant operation records.

Table 5-1 Categories of Discharges and Typical Annual Discharges to the IWD

Categories of Discharges to the Industrial Waste Ditch	Estimated Annual Volume (Gallons/Year)	Examples of Wastes Potentially Discharged
Run-Off (rain and snow melt)	33,000,000[1]	Residual oils, metals, hydrocarbons
Prototype and Auxiliary Operations	70,000,000[2]	Waste oil, water treatment chemicals, chemical reagents, surfactants, cleaning chemicals, chlorinated and fluorinated compounds
Cooling Systems	500,000	Water treatment chemicals
Ion Exchange Regeneration	4,000,000[3]	Acidic and basic solutions
Laboratory Operations	1,000	Laboratory chemical analysis wastes, including dilute metal compounds, reagents, chlorinated compounds, preservatives, acids and bases, nitrates
Photographic Operations	1,000	Photographic solutions and reagents, preservatives
Total	107,503,000 gal/year	

[1] Volume may range as high as 40,000,000 gallons

[2] Volume may range as high as 79,000,000 gallons

[3] Volume may range as high as 4,750,000 gallons

In 1980, NRF ceased the discharge of all RCRA wastes to the IWD with the exception of acidic and basic ion exchange regenerant solutions, which were self-neutralizing. This change from previous practice was part of a site improvement project, and was accomplished by replacing hazardous chemicals with non-hazardous chemicals, collecting and properly disposing of remaining waste streams, and implementing waste control procedures. Discharge of acidic and basic ion exchange regenerant solutions continued from June 1980 through March 1985. In April 1985, a neutralization facility consisting of two 15,000 gallon neutralization tanks was installed. Acidic and basic solutions were mixed, neutralized, and discharged to the IWD. The optimal pH control level at the facility is between 6.0 and 9.0 pH units. Since April 1985, the IWD has received only rain/snow run-off, facility discharge containing oily residues, non-hazardous industrial waste water, neutralization tank discharges containing a solution of acids and bases neutralized to a pH between 6.0 and 9.0, and infrequent discharges of laboratory chemical solutions.

The total volume of the sediment in the IWD containing inorganic waste was calculated to be 7,542 cubic meters (270,744 ft^3). This corresponds to a length of 1,768 meters (5,800 feet), a width of 4.74 meters (15.56 feet), and a depth of 0.9 meters (3 feet). The IWD sediment surface area was calculated to be 8,380 m^2 (90,248 ft^2).

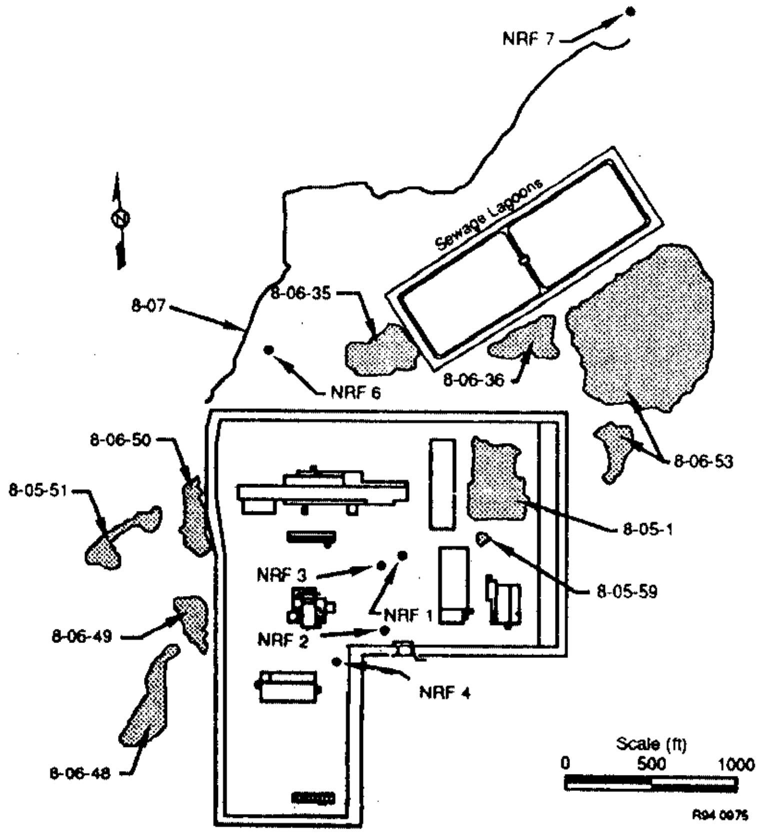

Figure 3 Schematic of Operable Units Described and NRF Wells

Landfill Units

The Landfill Units (Operable Units 8-05 and 8-06) include nine separate areas located on the west and northeast sides of the facility. The maximum area of the combined landfill units is 0.16 km^2 (1.64 x 10^6 ft^2). The landfill units are believed to have similar nonradiological wastes, migration paths, and risk factors. The wastes consisted of office trash, construction debris, cafeteria garbage, waste oils, chromate compounds, and small quantities of

Table 5-2 Summary of Landfill Units (8-05 and 8-06)				
Area	Primary Uses/Wastes	Dates of Operation	Dimensions	Appearance/Artifacts
8-05-1	Similar to municipal landfill; construction debris and refuse such as petroleum products, small quantities of paints and solvents, cafeteria wastes	1951-1960	107 x 137 meters (350' x 450'), depth of refuse 1.2-7.6 meters (4-25')	Eastern portion has construction rubble piles about 1 meter (3') high
8-05-51	Similar to municipal landfill; construction debris and refuse such as petroleum products, small quantities of paints and solvents, cafeteria wastes, material staging area and construction debris disposal	1957-1963	137 meters x 30.5 to 53.4 meters x 3.05-4.6 meters deep (450' x 100-175' x 10-15')	Covered disposal trench approximately 76.2 x 4.6-6.1 x 3.05-4.6 meters deep (250' x 15-20' x 10-15')
8-05-59	Possible landfill/burn pit	1951-1953	22.9 x 30.5 meters (75' x 100'), depth estimated at 6.1 meters (20')	No evidence of a landfill was found
8-06-35	Construction debris disposal	1960-1971	91.4 x 121.9 meters (300' x 400')	Mounded area containing gravel, sand, silty soil, concrete, wood, scrap metal
8-06-36	Construction debris disposal	1960-1971	Triangular; base about 91.4 meters (300') and altitude of 152.4 meters (500')	Very little surface debris, some natural sagebrush remains
8-06-48	Material staging area and construction debris disposal	1956-1964	198.1 (650') long x 22.9 to 53.3 meters wide (75' to 175')	Scrap wood and metal. Much of area is undisturbed
8-06-49	Construction staging area	1961-1963	106.7 meters (350') long x 7.6 to 45.7 meters (25' to 150')	Scrap wood and metal and concrete debris, no older vegetation remains, soil cover
8-06-50	Construction material staging and parking	1956-1959	137.1 meters (450') long x 15.2 to 45.7 meters (50' to 150')	No older vegetation present, no evidence of disposal
8-06-53	Similar to municipal landfill; construction debris and refuse such as petroleum products, small quantities of paints and solvents, cafeteria wastes	1956-1970	274.3 x 365.8 x 2 to 3 meters deep (900' x 1200' x 7' to 10')	Disturbed vegetation and soil, tire tracks

Areas recommended for the selected remedy appear in **bold** type.

miscellaneous chemicals from the Naval Reactors Facility. Chemicals which are known to have been disposed of in the landfills include low concentrations of silver nitrate and mercuric nitrate in solution, which were used in laboratory analyses. A review of historical records and interviews with former employees indicate that the waste was placed in unlined trenches or pits, burned, and the areas subsequently backfilled. Use of the last landfill was discontinued in 1971.

The objectives of the investigations were to determine the boundaries of the landfills, the depth of the cover, and the potential for ground water contamination and/or particulate or organic vapor release. Intrusive sampling to determine the landfill contents was not performed due to the heterogenous nature of the landfill contents. Table 5-2 summarizes information about the landfill units.

Records of what materials were deposited in the NRF landfills were not kept. However, records were kept of the materials shipped from NRF to the INEL Central Facilities Landfill after use of the last NRF landfill was discontinued in 1971. Since the operations and processes used at NRF remained constant, the types and quantities of wastes generated are not believed to have changed significantly over time. Therefore, these later records were used to estimate the volumes and concentrations of wastes disposed of prior to 1971 in the NRF landfills. In addition, historic photographs were reviewed, and employee interviews and a records search were conducted.

Table 5-3 NRF Waste Generation After 1971 and Prior Inferred Generation for Landfill Units Volume Calculation

Waste Type	Form	Average Annual Volume after 1971 (Cubic meters/year)	Inferred Average Annual Volume prior to 1971 (Cubic meters/year)
Office trash	Solid	4,655.8	3,119
Construction debris	Solid	1,571.2	1,052
Municipal waste	Solid	1,090	664
Waste oil	Liquid	23.8	16
Paint, thinner, solvents	Liquid	0.14	0.03
Acidic, basic, or metal-based solutions used in plant operations or analytical chemistry procedures	Liquid	2.2	1.3
Chromate solutions	Liquid	2.5	1.7
Chemicals used for water treatment	Solid	0.6	0.4
Totals		7,346.2	4,854.4

Based on the number of major construction evolutions which were in progress during the time period the NRF landfills were in use, a considerable amount of the waste was probably construction debris. After 1965, the quantity of construction debris disposed of probably decreased due to the reduced number of construction projects. In addition, a smaller volume of plant-related waste was generated and sent to the Naval Reactors Facility landfills prior to 1965, since only two prototype plants were operating. This volume of waste can be conservatively estimated from later records by applying a reduction factor. Table 5-3 provides information about waste generated after 1971, and an estimate of the waste generated prior to that time. Table 5-4 estimates the volume of waste disposed of in each landfill unit. For the landfills, the three waste types of concern are waste oil, solvents, and chemicals. Soil gas samples were collected and analyzed for volatile organic compounds to screen for waste oils and solvents.

Table 5-4 Estimated Total Volume of Waste Disposal to NRF Landfill Units (m^3)

Year	8-05-1	8-05-51	8-06-53	Total	CFA
1956	2,540		2,382	4,922	
1957	2,310	230	2,382	4,922	
1958	2,310	230	2,382	4,922	
1959	2,310	230	2,382	4,922	
1960	2,310	230	2,382	4,922	
1961		230	2,382	4,922	2,310
1962		230	2,382	4,922	2,310
1963		230	3,555	7,346	3,561
1964			3,555	7,346	3,791
1965			3,555	7,346	3,791
1966			3,555	7,346	3,791
1967			3,555	7,346	3,791
1968			3,555	7,346	3,791
1969			3,555	7,346	3,791
1970			3,555	7,346	3,791
Total	11,780	1,610	45,114*	93,222	34,718
Capacity	55,064	1,612	22,585	79,261	NA

*Assumes this volume was reduced by 50 percent as a result of incineration.

Radioactivity Controls

At NRF, systems which contain radioactive liquids (e.g. reactor coolant, radiochemistry laboratory liquid discharge) with beta, gamma, and alpha emitting radionuclides are physically isolated from those systems which discharge to the IWD. Waste water containing radioactivity is contained in separate, monitored systems which are isolated from those carrying other site effluents. Waste water containing radioactivity is collected, processed to remove the radioactivity, and reused rather than discharged to the environment. The process systems include collection tanks, particulate filters, activated carbon columns, and/or mixed bed ion exchange columns to remove radioactivity from the water. Strict operational procedures have been used from the start of operations at NRF to control the release of radioactive materials.

The effectiveness of this program is demonstrated by the results of sediment, soil, and vegetation samples collected through routine environmental monitoring from the IWD. The results indicate that radionuclides are not a contaminant of concern for OU 8-07. Table 5-5 provides a summary of the routine soil, sediment, vegetation, and water samples collected for radiological analysis in 1991.

Table 5-5 Summary of Routine Radiological Monitoring at the NRF IWD in 1991

	Soil[1] (pCi/gm)			Sediment[2] (pCi/gm)		Vegetation (pCi/gm)		Water[3] (10^{-8} uCi/ml)		
	MEAN	MAX	SL	MEAN	MAX	MEAN	MAX	MEAN	MAX	SL
Cobalt-60	<0.1	0.22	[4]	<0.38	1.18	<0.36	<0.52	<5.5	<5.9	300
Cesium-137	0.25	0.49	1.3	0.36	0.60	<0.18	<0.26	[5]	[5]	[5]

pCi/gm Picocurie (10^{-12} curie) per gram
SL Risk based screening level

[1] < in front of a maximum value signifies LESS THAN the minimum detectable activity (MDA). A mean value preceded by < contains at least one value below MDA.

[2] Sediment samples are collected from the A1W and S5G cooling towers, and the sewage lagoons; i.e., material which has been deposited by water.

[3] Water samples are analyzed for all gamma rays with energies between 0.1 and 2.1 MeV. This energy range includes Cobalt-60, Cesium-137, and a wide variety of other radionuclides of both natural and man-made origin. The concentrations shown for Cobalt-60 are less than the minimum detectable concentrations for the analysis, assuming all gamma rays detected had come from that one radionuclide.

[4] While no specific screening level for Cobalt-60 has been established, the Cesium-137 screening level may be used for comparison, since Cobalt-60 has a much shorter halflife and comparable dose conversion factors for both internal and external exposure.

[5] Cesium-137 is included in the equivalent Cobalt-60 concentration discussed in (3).

Since 1953, routine radiological monitoring of process water, cooling water, effluent water, and buildings and grounds has been performed at NRF. Currently, water samples are collected weekly from the IWD and other discharge locations, and analyzed for gross gamma radioactivity using gamma spectrometry. All samples collected for non-radiological analysis are screened for radioactivity using a gamma detector prior to leaving NRF. Additionally, radiological surveys are performed along the IWD, and sediment, soil, and vegetation samples are collected and analyzed for gross gamma radioactivity on an annual basis from five locations in the interior and exterior IWD. Cobalt-60 and Cesium-137 are the predominant radionuclides identified during this analysis. These two radionuclides are used to assess the presence of radioactivity during environmental monitoring at NRF, since they are easily detectable and are present with other NRF isotopes.

5.1 Summary of Environmental Monitoring Data

5.1.a IWD Remedial Investigation Soil Samples

Sediment samples from the IWD channel were first collected for characterization in 1985, and were analyzed for chromium and silver concentrations based on process knowledge. Detailed characterization sampling was initiated in 1986. Core samples collected in November 1986 indicated that chromium, copper, lead, mercury, nickel, silver, and zinc were present in the channel sediments. The only volatile organic compound present in the samples was methylene chloride, which is a common laboratory contaminant. In 1987/88, eighteen soil samples were collected to determine background levels. Composite core dredge pile samples were collected in 1987, and analyzed for metals and Appendix VIII constituents (chemicals which have been shown to have toxic, carcinogenic, mutagenic, or teratogenic effects on humans). Only chromium and mercury were found to have concentrations above background levels.

Soil samples collected for the Remedial Investigation in 1992 were categorized into three types; sediment samples from the ditch channel, dredge pile samples, and subsurface samples from the beneath the ditch channel and on either side at set intervals. These samples were analyzed for metals, volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), pesticides, total petroleum hydrocarbons (TPH), and benzene, toluene, ethylbenzene, and total xylenes (BTEX). The vast majority of VOC and SVOC analyses results reported concentrations below the Method Detection Limit (MDL); however, there were a few indications of organic substances, such as acetone, detected in some samples. All of the volatile organic values reported above MDL were interpreted as resulting from laboratory background, since many of these compounds are frequently used in the laboratory or are common laboratory contaminants. None of these identified contaminants were considered during risk assessment calculations.

Compounds only identified in the dredge piles include one observation each of 1,2,4-trichlorobenzene, naphthalene, phenanthrene, benzo(a)anthracene, benzo(a)pyrene, and benzo(g,h,i)perylene, and two observations each of chrysene and benzo(b)fluoranthene. These SVOCs are sometimes associated with coal tar and are possibly air deposited remnants burning heavy fuel oil (#5 & #6) at the NRF boilerhouse, which provides steam heating for the site. These compounds were detected in only a few locations and are not considered to be contaminants of concern or representative of the site. Five observations of the compound pentachlorophenol were made in the dredge piles, with concentrations averaging 0.256 ppm. This compound is commonly used as a wood preservative, and may have leached from the treated wood used in the cooling towers (part of the site circulating water system).

The majority of volatile organic compounds were reported at concentrations below the MDLs of the chemical analyses. Volatile samples reporting concentrations above MDLs have been identified as resulting from laboratory or field contamination, except for benzene, toluene, ethylbenzene, and total xylene (BTEX) values reported in one ditch sediment sample. These compounds are commonly associated with gasoline and other refined petroleum products, and their presence is viewed as an isolated occurrence from a localized release of oil. No further analysis of the volatile data was conducted, and no calculations for risks from volatile compounds were made in the risk assessment.

The majority of the semi-volatile organic compounds were reported at concentrations below the MDLs. Some of the semi-volatile compounds were detected in the quality control samples and the trip blanks. Because these compounds were detected in the quality control samples, they were not included in the risk assessment. Most of the semi-volatile compounds that were detected in the IWD sediments and dredge piles are related to a constituent in coal tar, and were only found in one or two samples, and are not considered representative of site conditions.

Pesticide, herbicide, and polychlorinated biphenyls (PCB) analyses were conducted on samples from eight ditch sediment locations. All results were reported below the MDLs, except for one sample which showed lindane at 0.0006 milligrams per liter (mg/l). Lindane was not included in the risk assessment because this one sample was not considered representative of the site.

Total petroleum hydrocarbon (TPH) analyses were conducted on selected samples. Most of the petroleum products found in the IWD are releases from pumps, compressors, and turbines during normal operations. Seven sediment samples reported TPH values from 68 to 3,600 ppm. TPH values in background samples ranged from <10 to 27 ppm with a mean of 16 ppm. There was not a consistent decrease in TPH concentration with distance from the discharge point. The lack of elevated BTEX concentrations indicates the elevated TPH values are the result of longer chain hydrocarbons (e.g., motor oil, diesel, etc.) which tend to contain small quantities of these constituents. This data is for general evaluation purposes only, since TPH does not have a health-based standard for use in a risk assessment at this time.

The inorganic sample results for the IWD indicated that the constituents of concern were barium, chromium, copper, mercury, nickel, silver, and zinc. Table 5-6 summarizes the results of sampling inorganics in the IWD.

Subsurface soil samples were also collected from cross-sectional borings. Only five samples collected from these borings had slightly elevated metals concentrations. The distribution of elevated metals concentrations in subsurface soils appears to be restricted to within at least two, but no more than ten feet laterally from the IWD, and primarily within seven feet below the elevation of the static water level (BSWL). Occasional elevated concentrations were observed at depths of between five and 30 feet below ground surface (BGS).

Three areas of the IWD displayed peak constituent concentrations which were generally higher than surrounding areas. These "hot spot" areas of the IWD are located near the outfall (discharge point) in the first 500 feet, downstream between 3,000 and 3,300 feet, and downstream between 5,500 and 6,500 feet. This appears to be the result of a longer period of accumulation of metals in the sediments plus the deposition of metal contaminated solids remobilized by upstream dredging activities.

Table 5-6 Contaminant Concentrations in IWD Soils in Parts Per Million (ppm)													
Constituent	95% UCL of Mean Background (Normal Distribution)	95% UCL of Mean Sediment (Log Normal Distribution)	95% UCL of Mean Dredge Pile (Log Normal Distribution)	Average of 95% of UCL Sediment + Dredge Pile	Hot Spot from Outfall to 500' Average			Hot Spot from 3000' to 3300' Average			Hot Spot from 5500' to 6500' Average		
					Sed	Dredge	Comb[1]	Sed	Dredge	Comb[1]	Sed	Dredge	Comb[1]
Barium	263.61	271.07	234.44	252.76	282.17	218.0	238.26	222.25	238.78	233.69	246.33	325.77	300.68
Total Chromium	30.79	102.16	109.99	106.08	91.32	65.22	73.46	53.08	295.87	221.16	58.47	136.28	111.71
Hexavalent Chromium[2]	1	1	1	1	1	1	1	1	1	1	1	1	1
Copper	27.02	37.96	25.32	31.64	64.43	22.24	35.56	37.96[3]	32.09	33.9	28.38	30.05	29.53
Mercury	0.11	1.84	0.39	1.12	1.28	0.26	0.58	1.84[4]	0.52	0.92	1.80	1.19	1.38
Nickel	36.66	26.21	29.58	27.9	28.57	27.91	28.12	26.21[3]	31.17	29.64	20.93	30.32	27.36
Silver	0.77	1.13	1.00	1.07	1.25	0.78	0.93	0.89	1.18	1.09	0.89	1.29	1.17
Zinc	162.68	156.46	176.06	166.26	130.45	156.07	147.98	156.46[3]	420.43	339.21	112.48	176.69	156.42

[1]The combined averages for the hot spots are the averages of all samples collected in these areas, and do not equal the average sediment value + the average dredge pile value/2 shown on this table.

[2]The method detection limit is used for hexavalent chromium in soil because of difficulty achieving the analysis time requirement. See Section 4.5 of the Final RI/FS Report for the IWD for additional information.

[3]The wrong laboratory analysis number was submitted with the data group in which this sample was included. The 95% UCL of mean sediment values is used for risk calculation purposes.

[4]Mercury analysis results from these samples were rejected by the data validator. The 95% UCL for sediment was used for risk calculations.

The dredge piles did not have areas identified as "hot spots". The total volume of soil in the dredge piles was estimated to be 2,972.6 cubic meters (104,976 cubic feet). The surface area of the dredge piles was calculated to be 7,583.7 m^3 (81,633 ft^3).

5.1.b Landfill Units

Geophysical and soil gas surveys were conducted to determine the overall boundaries of the waste disposal areas, and if they exist, the boundaries of specific trenches in these areas. Magnetometer surveys were conducted in 8-05-1, 8-05-51, and 8-06-53. Soil gas samples were analyzed for benzene, ethylbenzene, toluene, xylenes, and 1,1,1-trichloroethane. Portable gas detection instruments were also used to monitor for methane, combustible gases, hydrogen sulfide, and total volatile organic compounds. Surface soil samples were collected and analyzed for inorganic constituents. A soil gas/vapor surface emissions survey was conducted over the estimated locations of the trenches as delineated in the magnetometer survey.

Based on process knowledge, photographs, employee interviews, visual inspection, and existing analytical data, 8-06-35, 8-06-36, 8-06-48, 8-06-49, and 8-06-50 were determined to pose no unacceptable risk.

Surface Soil Gas Emissions Survey

A surface soil gas emissions survey recorded values at 10 foot intervals between staked grid locations within zero and six inches of the ground surface. No readings were found above the ambient air upwind concentrations, except where vapors were released from disturbed vegetation.

Soil gas surveys detected volatile organic compounds (primarily ethylbenzene and xylenes) which may be associated with solvents at 8-05-1, 8-05-51, and 8-06-53, and further defined the boundaries of the landfills. Benzene was not detected in any of the soil gas samples, and toluene was detected in four samples.

Although there were some positive detections of meta- and para-xylene at 8-05-59, these results were, in general, only slightly elevated above associated blank samples (and were considerably lower than the concentrations detected at 8-05-51). This area received a one-time discharge of 50,000 gallons of waste oil. There is a large amount of uncertainty associated with the location of the disposal pit, the presence of a building over much of the suspected site location, the short duration of the disposal period, and the long elapsed time since the occurrence of the disposal. Modeling was conducted to determine the possible effect to ground water of a one time release of 50,000 gallons of waste oil containing hazardous constituents. The results of this modeling showed that concentrations of the representative compounds would not exceed MCLs. These results are considered conservative because eyewitness reports indicate that the contents of the pit burned for three days following the oil discharge (which should have significantly reduced the source volume).

Soil Samples Analyzed for Inorganic Constituents

Thirty-two surface soil samples were collected from 8-06-53, and were analyzed for metals content. Cadmium, mercury, selenium, and silver were not detected in any of the 32 samples. Arsenic, barium, chromium, and lead were detected in all samples. Some soil samples from NRF-51 had concentrations of barium and mercury which exceeded the background Idaho National Engineering Laboratory threshold level.

Magnetometer Surveys

Six small linear anomalies in 8-05-51 were interpreted as possible debris-filled trenches. A broad, moderate-sized anomaly zone corresponded with a visible trench approximately 2 to 3 feet deep. A section of the trench was scraped to very shallow bedrock. Another smaller, moderate anomaly was also associated with a shallow depression. The magnetic survey over 8-06-53 was successful in identifying possible debris-filled trenches. Six linear anomalies with various orientations were interpreted as representing the extent of the trench and fill activity at 8-06-53.

5.2 Ground Water Samples

The NRF water supply has been monitored for physical parameters (conductivity and pH), radioactivity, chromium, sodium, and chloride from 1980 to the present by the United States Geological Survey (USGS). The quality of water in all samples was within the Idaho State regulatory limits; there were no out-of-specification values noted. NRF has monitored the domestic water system in accordance with Title 1 Chapter 8, Idaho Regulations for Public Drinking Water Systems, from 1987 through the present. Other data has been collected by subcontractor personnel. NRF has published the results of analysis of selected parameters in the annual Naval Reactors Facility Environmental Monitoring Report. Portions from the 1990 and 1991 reports which summarize the results of sampling for those parameters of specific concern are provided as Table 5-7. Figure 5-3 shows the location of NRF wells 1, 2, 3, 4, 6, and 7. Approximate locations and distances of wells downgradient from NRF are: USGS well 97, 1.0 mile south; well 98, 2.7 miles southwest; well 99, 2.2 miles south; well 102, 0.25 miles west; and INEL-1, 2.5 miles west southwest. Approximate locations and distances of wells upgradient from NRF are: USGS well 12, 2.5 miles north; well 15, 3.5 miles north; and well 17, 3 miles northeast.

Predicted Ground Water Values

GWSCREEN is a semi-analytical model used for assessment of the ground water pathway from the surface to an underlying aquifer. NRF used this program to assess the impact of a contaminant release from the sediments associated with the IWD and from the contents of the landfill. The limiting soil concentration is the soil concentration such that, after leaching and transport, maximum allowable concentrations in ground water are not exceeded. Maximum allowable concentrations are based on chemical toxicity, and maximum contaminant levels (MCLs) as listed in Title 40 Code of Federal Regulations (CFR) 141 and associated amendments. The concentration in ground water is proportional to the soil concentration (excluding solubility limited releases). Table 5-8 provides the maximum predicted ground water concentration in each Operable Unit and ground water concentration of each constituent of concern.

Table 5-7 Comparison of Results of Analysis of Selected Ions and Nutrients in NRF Ground Water(a)									
Parameter	Units	Standard/ Guideline	Upgradient(k) (USGS Wells 12, 15, 17)		Onsite (NRF Wells 1, 2, 3, 4)		Monitoring (NRF Wells 6, 7)	Downgradient(k) (USGS 97, 98, 99, 102, INEL-1)	
			1990	1991	1990	1991	1991 only	1990	1991
Ammonia plus Organic N (as N)	mg/l	(c)	<0.3	<0.20	<0.3	<0.32	(i)	<0.3	<0.28
Bromide	mg/l	(c)	<0.02	0.05±0.02	0.07±0.01	0.07± 0.01	0.05±0.04	0.11±0.11	0.11±0.11
Chloride	mg/l	250(b)	18±13	16±11	38±6	41±7.2	110±120	43±38	41±33
Chromium	mg/l	0.05(e)	0.006±0.003	<0.004	0.01±0.002	0.010±0.002	0.021±0.014	0.008±0.003	0.008±0.003
Fluoride	mg/l	4.0(e)	<0.2	0.2±0.1	<0.2	0.2	0.2±0.1	<0.2	<0.2
Iron	mg/l	0.3(b)	<0.082	<0.11	<0.055	<0.13	0.33±0.24	<0.274	0.29±0.49
Lead	mg/l	0.05(e)	<0.001	<0.001	<0.001	<0.002	<0.001	<0.003	<0.002
Mercury	mg/l	0.002(e)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Nickel	mg/l	(c)	<0.001	<0.001	<0.002	<0.002	0.011±0.007	<0.002	<0.002
Nitrite (as N)	mg/l	(c)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrite plus Nitrate (as N)	mg/l	10(e,f)	1.0±0.7	0.93±0.67	1.7±0.2	1.8±0.11	0.94±0.65	2.4±1.7	2.33±1.52
Nitrogen, Ammonia dissolved	mg/l	(g)	(j)	<0.01	(j)	<0.01	<0.01	(j)	<0.21
Organic Carbon, Total	mg/l	(c)	<0.2	0.3±0.1	0.4±0.1	0.6±0.4	0.9±0.3	0.4±0.2	0.4±0.2
Orthophosphate (as P)	mg/l	(c)	<0.01	<0.01	<0.02	<0.02	0.03± 0.02	<0.01	<0.01
pH	pH Units	6.5-8.5(b)	7.9±0.2	8.0±0.2	7.9±0.2	8.0±0.1	8.2±0.4	7.9±0.1	8.0
Silver	mg/l	0.05(e)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Sodium	mg/l	20(d)	10±4	9.7±4.1	15±2	14±3.3	49±46	13±3	12±3.1
Specific Conductance	µmho/cm	(c)	425±130	412±131	587±41	592±28	809±648	568±124	563±120
Sulfate	mg/l	250(b)	25±7	23±7	40±5	43±6	130±130	40±27	33±13

(a) Values preceded by < contain at least one less than minimum detection level value in the analysis results.
(b) Secondary maximum contaminant levels per Title 1, Chapter 8, Idaho Regulations for Public Drinking Water Systems are provided for comparison.
(c) No standard or guideline available.
(d) No maximum per Title 1, Chapter 8, Idaho Regulations for Public Drinking Water Systems. 20 mg/l is suggested as optimum.
(e) Maximum contaminant levels per Title 1, Chapter 8, Idaho Regulations for Public Drinking Water Systems.
(f) The limit is for Nitrate (As N) only. Since nitrite values are near or below MDL, these quantities represent Nitrate (As N).
(g) The following parameter values are anomalously high for USGS Well 15 in the 8/6/90 sample: Chromium - 21 µg/l; Iron - 4600 µg/l; Manganese - 100 µg/l; Nickel - 15

μg/l; Organic Carbon, Total - 1.5 μg/l; Turbidity - 22 NTU. These values are not included in the values for the upgradient wells.

(h) Anomalously high value of 1400 μg/l reported for NRF Well 4 in the 6/19/90 sample. This value is not included in the values for the onsite wells.

(i) Ammonia plus organic nitrogen (as N) was not performed for NRF wells 6 and 7.

(j) Not measured.

(k) Upgradient and downgradient wells are off the map provided by Figure 3.

Table 5-8 GWSCREEN - Predicted Peak Ground Water Concentrations and Limiting Soil Concentrations for IWD and Landfill Unit Constituents

Contaminant	IWD[1]	8-05-1		8-05-51		8-06-53	
	Predicted Peak Ground Water Concentration (mg/L)	Limiting Soil Concentration (mg/m^3)	Predicted Peak Ground Water Concentration (mg/L)	Limiting Soil Concentration (mg/m^3)	Predicted Peak Ground Water Concentration (mg/L)	Limiting Soil Concentration (mg/m^3)	Predicted Peak Ground Water Concentration (mg/L)
Barium	43.6	NA	NA	2.8×10^{7}	2.67×10^{-3}	NA	NA
Chromium $^{+3}$	3.5	1.3×10^{6}	5.87×10^{-2}	NA	NA	1.8×10^{-1}	9.0×10^{-2}
Copper	5.6	NA	NA	NA	NA	NA	NA
Mercury	0.2	1.8×10^{4}	3.57×10^{-5}	2.2×10^{6}	1.34×10^{-3}	1.1×10^{-2}	5.19×10^{-6}
Nickel	4.1	NA	NA	NA	NA	NA	NA
Silver	0.01	2.7×10^{5}	3.6×10^{-4}	NA	NA	1.82×10^{-1}	5.15×10^{-4}
Zinc	144	NA	NA	NA	NA	NA	NA

NA The constituent was not identified in the waste disposal area

[1] Limiting soil concentration was not calculated for the IWD because data from the RI/FS was available for risk calculations

[2] Limiting soil concentration from GWSCREEN Version 1.5

[3] Limiting soil concentration from GWSCREEN Version 2.02

5.3 Shallow Perched Water Table

Shallow perched water was only evaluated in the IWD RI/FS. During the summer of 1991, two deep monitoring wells and 15 shallow piezometer wells were drilled in the vicinity of the IWD. Six of these wells encountered shallow perched water, and the rest were dry.

Samples were collected from the shallow perched water table and analyzed for the constituents listed in Appendix VIII of Title 40 Code of Federal Regulations (CFR) Part 261. Data on background water quality are not available for the shallow perched water table, but all volatile and semi-volatile organic analytes were reported at concentrations below Federal Primary and Secondary drinking water standards, or were interpreted as resulting from laboratory background influences. Observed concentrations of metals in the shallow perched water zone were below Federal Primary and Secondary drinking water standards, and may represent background levels. These data suggest that any impacts from the IWD are minor.

6. SUMMARY OF SITE RISKS

The Remedial Investigation/Feasibility Study performed on the IWD evaluated the potential risks for both human health and environmental effects in accordance with the EPA *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual*, *Volume II: Environmental Assessment Manual*, and other EPA guidance. The risks associated with the Landfill Units were evaluated under the Track II Guidance. The Agencies agreed that the Presumptive Remedy for CERCLA Municipal Landfill Sites was applicable to Operable Units 8-05-1, 8-05-51, and 8-06-53 because they are suspected to contain wastes similar to those found in municipal landfills. This assumption allows corrective action to be taken without full characterization of the landfill contents, and therefore, applies available funding to remedial action, rather than additional investigation. Because the landfill contents were not fully characterized, assessment of the associated risk presents a large amount of uncertainty.

The Presumptive Remedy relates primarily to containment of the landfill contents and collection and/or treatment of landfill leachate. Although some of the potential risks associated with the Landfill Units (8-05-1, -51, and 8-06-53) were evaluated for human health, (see the Summary Reports for Operable Units 8-05 and 8-06) because the contents of the units were not sampled, there is a large amount of uncertainty inherent to risk calculations for these areas. An ecological risk assessment was not conducted for the Landfill Units. However, the protectiveness of the presumptive remedy chosen for these sites will reduce the potential risk to ecological receptors, and a detailed ecological risk assessment will be conducted in the Naval Reactors Facility Comprehensive Remedial Investigation and Feasibility Study.

6.1 Human Health Risks

Evaluation of human health risk included contaminant identification, exposure assessment, toxicity assessment, and health risk characterization. The potential contaminants were identified based on existing inventory records, process knowledge, and initial screening. The exposure assessments detailed the current and future exposure pathways that exist at the sites for workers and residents. The toxicity assessments documented the adverse effects that may be caused in an individual as a result of exposure to a site contaminant.

The human health risk assessment evaluated current and future potential carcinogenic and noncarcinogenic risks associated with exposure to the identified contaminants. The risk assessment used the exposure concentrations and the toxicity data to determine hazard indices for potential noncarcinogenic effects and excess cancer risk levels for potential carcinogenic contaminants. The chronic hazard index for each constituent and specific exposure route was quantified as the constituent intake through the exposure route divided by the corresponding constituent and route-specific reference dose (RfD). A chronic hazard index less than or equal to 1.0 indicates with a high degree of confidence that no adverse health effects will be experienced by any member of the general population. Hazard indices greater than 1.0 require further considerations and risk management decisions.

The excess cancer risk is the increase in the probability of contracting cancer as a result of exposure to hazardous constituents. The carcinogenic risk multiplies each constituent intake by the route-specific slope factor. The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) acceptable risk range is 1 in 10,000 to 1 in 1,000,000. An excess lifetime cancer risk of 1 in 10,000 indicates that an individual has up to one chance in 10,000 of developing cancer over a lifetime of exposure to a site-related contaminant.

6.1.1 Contaminants of Potential Concern

6.1.1.a Industrial Waste Ditch

The results of previous investigations and the Remedial Investigation for the Industrial Waste Ditch indicated that the constituents of concern were barium, chromium, copper, mercury, nickel, silver, and zinc. Table 6-1 summarizes the analyses results for the IWD. Analyses results for mercury and chromium had the greatest deviation from the mean background values, and elevated levels of silver, zinc, copper, and barium were also reported.

Table 6-1 Summary of IWD Metals Analysis Results in Parts per Million (ppm)

Constituent	IWD Sediment Mean	IWD Sediment 95% UCL	Dredge Piles Mean	Dredge Piles 95% UCL	NRF IWD Background Mean	NRF IWD Background 95% UCL
Barium	231.34	271.07	210.32	234.44	240.45	263.61
Total Chromium	69.76	102.16	51.33	109.99	28.40	30.79
Copper	31.16	37.96	21.24	25.32	24.35	27.02
Lead	9.99	11.21	10.98	11.94	15.94	17.89
Mercury	0.74	1.841	0.20	0.39	0.11	0.11
Nickel	21.24	26.21	27.91	29.58	33.68	36.66
Silver	0.91	1.13	0.83	1.00	0.72	0.77
Zinc	120.84	156.46	133.79	176.06	147.32	162.68

Mean — The arithmetic average of the analysis results
UCL — Upper Confidence Level of the mean value

6.1.1.b Landfill Units

The initial scoping of the landfill units reviewed waste generation processes and waste disposal records from the time of the landfill operations, sampling evolutions performed during subsequent construction evaluations, and subsequent records of waste shipments to the Central Facilities Landfill. Sampling for the Track 2 evaluation focused on the chemicals of potential concern identified through this data collection and evaluation process, and are presented in Table 6-2. Because the volume and heterogeneity of landfill contents make characterization extremely difficult, constituent concentrations in the landfill contents are assumed, although magnetometer readings were used to better define the boundaries of the landfill areas. Surface contents and offgases were directly sampled.

Tetrachloroethylene and 1,1,1-trichloroethane were detected in 8-05-1 and 8-05-51, but were not included in the table because they were also present in control samples. Ethylbenzene was detected at 8-05-1, and m,p-xylenes and o-xylenes were detected in most of the soil gas samples from 8-05-1 and 8-05-51. However, because no RfDs are available for the xylenes, they are not included in the risk assessment.

Barium and mercury exceeded the background upper tolerance limit in soil samples from 8-05-51 and chromium exceeded the background upper tolerance limit in one surface soil sample from 8-06-53. Chromium, mercury, and silver were identified as contaminants of concern in buried waste in all units, based on historical records of waste streams at NRF.

Table 6-2 Summary of Chemicals of Potential Concern in Landfill Units

Chemical	Surface Soils (mg/kg)	Soil Gas (ug/L)	Predicted Concentration
8-05-1			
Ethylbenzene	NS	0.2 - 1.0	NA
m,p-Xylenes	NS	0.3 - 5.2	NA
o-Xylene	NS	0.3 - 4.8	NA
8-05-51			
Barium	94.8 – 265	NA	NA
Mercury	0.15 – 0.65	NA	NA
m,p-Xylenes	NS	0.3 – 0.5	NA
o-Xylene	NS	0.3 – 0.5	NA
8-06-53			
1,1,1-Trichloroethane	NS	1.25	NA
Tetrachloroethylene	NS	1.39	NA
Chromium	21.1 - 72.3	NS	11.8*
Mercury	NA	NS	0.52*
Silver	NA	NS	4.6*

NA - Not Applicable
NS - Not Sampled
* - Assumed

6.1.2 Exposure Assessment

The potential populations at risk were identified for current and future use scenarios. Occupational exposures were determined for current and future populations, and residential exposure was considered for future scenarios. The IWD evaluation included a future agricultural scenario, and the Landfill Units included a recreational scenario. General assumptions of the frequency and duration of exposures were based on both EPA standard default values and site-specific information. The Risk Assessment Guidance for Superfund (RAGS) provided many of the default values for inhalation and ingestion rates, and food and water consumption. Site-specific information, such as climate and geology, were also used to determine exposure pathways, and values. The exposure pathways evaluated for the IWD and the Landfill Units were soil ingestion, dust inhalation, and ground water ingestion. The IWD assessment also considered dermal exposure to surface soil and surface water, and ingestion of homegrown fruits and vegetables.

6.1.2.a IWD

The constituent concentrations used in the IWD risk assessment were provided in Table 6-1.

6.1.2.b Exposure Concentrations for Limiting Soil Concentrations for Landfill Units

Because non-intrusive sampling was utilized for the Landfill Units, the soil concentrations required to perform risk assessments had a high degree of uncertainty. To ensure that the potential hazards associated with the area were thoroughly understood, risk-based soil concentrations for these areas were calculated (Table 6-3). The risk based soil concentration is that level of a constituent at which it becomes a cause for concern (screening level). The equations for determining these risk-based soil concentrations are standard EPA equations for exposure and risk assessment with modifications to calculate a concentration in a medium at a specific risk level or target level.

6.1.3 Toxicity Assessment

The toxicity assessment data was obtained from the Integrated Risk Information System (IRIS), the Heath Effects Assessment Summary Tables (HEAST), and other EPA guidance. Contaminants of concern were evaluated for both carcinogenic effects and noncarcinogenic effects. The intake of each contaminant for each receptor along each exposure route was calculated.

The RfD is the toxicity value used to evaluate noncarcinogenic effects that result from exposure to chemicals, and is based on the concept that there is a threshold that must be reached before adverse effects occur. For carcinogenic contaminants, the chemical-specific slope factor (SF) is the toxicity value used to evaluate potential human carcinogenic effects. These toxicity values have been derived based on the concept that for any exposure to a carcinogenic chemical, there is some risk of a carcinogenic response. The SF is used in a risk assessment for the purpose of estimating an upper bound lifetime probability of an individual developing cancer from the exposure to a specific level of a carcinogen.

6.1.4 Risk Characterization

6.1.4 a. Industrial Waste Ditch

The levels of risk associated with background levels of contaminants in soil, air, and ground water were calculated to provide a comparison for future scenarios. These background samples were used for both dredge pile and sediment values. Ground water samples collected from the four NRF domestic water wells by the USGS from 1989 through 1992 were used to calculate concentrations in ground water.

Table 6-3 Risk Based Soil Concentrations for Landfill Units						
Pathway/Unit/Constituent			Occupational		Residential	
	RfD	Slope	Carcinogen	Noncarcinogen	Carcinogen	Noncarcinogen
Soil Ingestion			5.7/SF	RfD*2E6	0.64/SF	RfD*2.7E5
8-05-1						
Cr3	1.00E+00			2.00E+06		2.70E+05
Cr6	5.00E-03			1.00E+04		1.35E+03
Hg	3.00E-04			6.00E+02		8.10E+01
Ag	5.00E-03			1.00E+04		1.35E+03
Ethylbenzene	2.90E-01			5.80E+05		7.83E+04
8-05-51						
Ba	7.00E-02			1.40E+05		1.89E+04
Hg	3.00E-04			6.00E+02		8.10E+01
8-06-53						
Cr3	1.00E+00			2.00E+06		2.70E+05
Cr6	5.00E-03			1.00E+04		1.35E+03
Hg	3.00E-04			6.00E+02		8.10E+01
Ag	5.00E-03			1.00E+04		1.35E+03
1,1,1-Trichloroethane	5.20E-02			1.04E+05		1.40E+04
Tetrachloroethylene	1.10E+02			2.20E+08		2.97E+07
Inhalation of Fugitive Dust			1.4E-05*PEF/SF	RfD*5.1*PEF	8.5E-6*PEF/SF	RfD*3.7*PEF
8-05-1 Particulate Emission Factor = 7.60E+08						
Cr6		4.10E+01	2.60E+02		1.58E+02	
Hg	8.60E-05			3.33E+05		2.42E+05
8-05-51 Particulate Emission Factor = 4.75E+08						
Ba	1.00E-04			2.42E+05		
Hg	8.60E-05			2.08E+05		1.51E+05
8-06-53 Particulate Emission Factor = 2.11E+08						
Cr6		4.10E+01	7.20E+01		1.58E+02	
Hg	8.60E-05			9.25E+04		6.71E+04
Inhalation of Volatiles			1.4E-05*VF/SF	RfD*5.1*VF	8.5E-6*VF/SF	RfD*3.7*VF
8-05-1 Volatilization Factor for Ethylbenzene Occupational 3.77E+03 Residential 4.19E+03						
Ethylbenzene	2.90E-01			6.20E+03		0.00
8-06-53 Volatization Factor for 1,1,1-Trichloroethane Occupational 1.20E+03 Residential 1.32E+03; Volatization Factor for Tetrachloroethylene Occupational 2.90E+03 Residential 3.20E+03						
1,1,1-Trichloroethane	3.00E-01			1.84E+03		2.02E+03
Tetrachloroethylene		2.00E-03	2.03E+01		2.24E+01	

A Baseline Risk Assessment was performed to determine if any unacceptable levels of risk were associated with the Industrial Waste Ditch. Risk is characterized for human receptors in four scenarios (current and future occupational, future residential, and future agricultural receptors), and Table 6-4 summarizes the results of the IWD Baseline Risk Assessment (BRA). The risk assessment calculated risk for exposure to receptors from the IWD as a whole, using 95% upper confidence level of the mean soil concentration, and for three areas of the IWD which may have elevated metals concentrations in comparison to the overall IWD values ("hot spots") to ensure these calculations were truly protective of human health. The three hot spot areas are identified as Outfall to 500', 3000' to 3300', and 5500' to 6500'. In many cases, the risks are probably overestimated due to the conservative nature of the assumptions. An example is assuming that residents are exposed to airborne constituents 350 days a year.

The risk of cancer in all scenarios, including background, exceeded the threshold value of 1×10^{-6} due to the consideration of inhalation of hexavalent chromium in ground water. Because of the lack of sampling data for hexavalent chromium in ground water, the concentration of hexavalent chromium was considered equal to the total chromium value.

In conclusion, although there may be some health risk associated with the IWD in the future, the risk is not significant when compared to the background risk, and considering the conservative nature of the estimate.

Table 6-4 Summary of Baseline Risk Assessment for the IWD

	Current Occupational		Future Occupational		Future Residential		Future Agricultural	
	Hazard	Risk	Hazard	Risk	Hazard	Risk	Hazard	Risk
Background	0.0557	1.65E-06	NA	NA	0.749	1.39E-05	0.796	1.39E-05
95% UCL	0.057	1.65E-06	0.0696	1.66E-06	1.37	1.4E-05	1.03	1.4E-05
Outfall to 500'	NA	NA	NA	NA	1.32	1.4E-05	1.16	1.4E-05
3000' to 3300'	NA	NA	NA	NA	1.99	1.4E-05	2.13	1.4E-05
5500' to 6500'	NA	NA	NA	NA	1.94	1.4E-05	2.23	1.4E-05

6.1.4.b Landfill Units

The evaluations performed in the Track 2 investigations of the Landfill Units determined that there may be an unacceptable risk to future receptors from Landfill Units 8-05-01, -51, and 8-06-53 based on the results of soil gas surveys, surface soil samples, and records review. Landfill sites 8-06-35, 8-06-36, 8-06-48, 8-06-49, and 8-06-50 were evaluated using the existing data and historical information, and it was determined that these areas were primarily used for material and equipment staging and construction debris, and there was no unacceptable risk to receptors.

6.1.5 Uncertainties and Limitations

Uncertainties are associated with all estimates of cancer and noncancer health hazards. These uncertainties result from incomplete knowledge of many physical and biological processes, such as carcinogenesis. Where specific information is not available, it is necessary to make assumptions and/or use predictive models to compensate for lack of information. The assumptions, models, and calculations are chosen so that the resulting risk and hazard estimates are protective of human health. However, these assumptions usually result in a conservative estimate of risk.

6.1.5.a Industrial Waste Ditch

Residential scenarios assumed that receptors consume homegrown products three meals a day for 30 years and methylmercury would be present in future scenarios. This is unlikely, because it does not account for the consumption of commercially prepared food, or for the difficulty in converting inorganic mercury to methylmercury. The risk assessment also assumes that the receptor inhales hexavalent chromium during showering, although this is unlikely, and the toxicity data for the inhalation of hexavalent chromium is for fumes and particulates from industrial processes, rather than a residential exposure scenario.

6.1.5.b Landfill Units

The uncertainty associated with the identification of organic chemicals of potential concern for this site is considered high. However, since it was assumed that the presumptive remedy for landfills (EPA, 1993) was going to be used at this site and this would require monitoring, restrict access, and preventing contact with landfill contents, the source characterization of additional chemicals of concern was not investigated. Assumptions included a 50% reduction in waste volume during incineration, and that metals contamination was equally distributed throughout the landfill mass. Other uncertainties associated with landfill unit 8-05-59 were the location of the disposal pit, the presence of a building over much of the suspected site location, the short duration of the disposal period, and the long elapsed time since the occurrence of the disposal.

6.2 Environmental Risk Assessment

6.2.1 Exposure Assessment

6.2.1.a IWD Qualitative Ecological Risk Assessment

The ecological risk assessment qualitatively evaluated the potential ecological effects associated with the presence of the Industrial Waste Ditch. This investigation was performed in accordance with the EPA Risk Assessment Guidance for Superfund Volume II. The ecological risk assessment identified sensitive nonhuman species, and evaluated many of the same exposure pathways and contaminants as the human health assessment.

There is no evidence of sensitive plants in the IWD vicinity. The closest occurrence of sensitive plants to the IWD involves a tree-like Oxytheca (Oxytheca dendroides) for which the population of interest is located approximately six miles south of the IWD outfall, near the INEL Central Facilities Area (CFA). From the perspective of the ecological assessment endpoint, the risk posed to sensitive plants by the IWD appears to be negligible.

The only metals in the soil significantly above background are chromium and mercury. For sensitive species, such as raptors, to receive significant exposure, metals must be transferred from the soil to plants, the plants ingested by the small mammals, then the small mammals consumed by the raptors. The uptake level of chromium and mercury is 15.5 and 3.4 percent, respectively. When the plant is eaten by the small mammal, it will typically transfer between 5 - 20 percent of the metals content from the plant to the animal. Comparisons between metal concentrations in plants and algae at the IWD with those of similar species at the control site at Mud Lake indicate that the IWD does not represent a significantly greater risk through this segment of the food web than background areas.

The IWD poses no significant risk to sensitive plants at the INEL, since no credible proximity of these plants to the ditch is known. The risk posed to sensitive animals is also considered small, but is less well defined, since the animals are mobile. Comparisons between metal concentrations in IWD plants and in plants from a control area indicate that the IWD is not responsible for a significantly greater risk through this segment of the food web. Other food web segments, as well as other exposure pathways, have not been quantified due to lack of available data.

6.2.1.b Landfill Units

An ecological risk assessment was not performed as part of this evaluation, and ecological risk will be assessed in the Naval Reactors Facility Comprehensive Remedial Investigation and Feasibility Study.

7. DESCRIPTION OF NO ACTION DECISIONS

On the basis of the results of the human health and ecological risk assessments conducted for the RI/FS, it was concluded that there are no unacceptable risks associated with the IWD. Therefore, the DOE has determined that no remedial action is necessary for this site.

In addition, the DOE has determined that no further action is needed for units 8-05-59, 8-06-35, -36, -48, -49, and -50. On the basis of the Track 2 evaluations, it was determined that no significant sources of contamination exist at these sites. Consequently, it was decided that these sites pose no unacceptable risks to receptors, and therefore, no remedial actions are necessary.

The EPA approves of these no action decisions, and the IDHW concurs. Both the EPA and the IDHW have been involved in the development and review of the RI/FS and Track 2 reports, the Proposed Plan, this ROD, and other project activities such as public meetings.

The remainder of this ROD discusses landfill units 8-05-1, -51, and 8-06-53. These three units may pose unacceptable risks to receptors, and thus require remedial action.

8. DESCRIPTION OF ALTERNATIVES

8.1 Remedial Action Objectives

The purpose of remedial action objectives (RAOs) is to set measureable goals for protection of human health and the environment. RAOs were not developed for the IWD because no unacceptable risks to human health or the environment were found. RAOs were developed for the three Landfill Units (OUs 8-05-1, 8-05-51, and 8-06-53) at which response action will be taken.

The primary remedial action objective is to contain the landfill contents, minimizing the risk associated with potential contact of the contents with ground water. The landfill contents were not sampled or characterized. Consequently, it was difficult to accurately assess the risk to future receptors. Development of the RAOs was guided by, and consistent with, the Presumptive Remedy for CERCLA Municipal Landfill Sites. The Presumptive Remedy directs that containment be accomplished by installing a cover to reduce permeability and imposing land use restrictions to preserve the cover.

8.2 Summary of Alternatives for Landfill Units

The presumptive remedy for landfills (EPA, 1993) which requires monitoring, restricted access, and prevention of contact with landfill contents will be used to protect potential receptors. General Response Actions (GRAs) have been assembled into a set of remedial action alternatives designed to represent a range of options. The remedial action alternatives developed include:

Alternative 1: No Action

Alternative 2: Containment with Native Soil Cover

Alternative 3: Containment with Single Barrier Cover

The following descriptions of the remedial action alternatives explain the logic behind the assembly of GRAs into specific alternatives.

8.3 Alternative 1: No Action

Alternative 1 is required for consideration by NCP 300.430 (e)(6) as a baseline alternative. Under this alternative, the landfill contents would be left in place. No sampling or monitoring would be performed for the no action alternative under the Federal Facility Agreement and Consent Order (FFA/CO).

8.4 Alternative 2: Containment with Native Soil Cover

This alternative involves the containment of landfill contents by covering with a native soil cover. There are four components of this alternative: obtaining a deed restriction; capping each landfill area; monitoring; and performing operations and maintenance on each soil cover. (1) A deed restriction would be obtained for each area, including an additional 50 feet beyond each landfill boundary to protect the integrity of the cover. This would limit the sale and use of the property. The area would be surveyed and signs would be installed to warn of the presence of the landfill and potentially contaminated soils. (2) The landfill areas would be capped using conventional construction equipment to ensure a native soil cap 24 inches thick covers the entire landfill area to prevent contact with the contents and minimize the potential for infiltration. The 24 inch thick cover is the minimum landfill cover thickness. The soil cover would be graded, and natural vegetation planted to stabilize the soil surface, promote evapotranspiration, and decrease erosion of the soil cover. (3) Soil gas monitoring would be performed to assess the effectiveness of the cover, and ground water monitoring would be performed to assess these areas and other areas at NRF. (4) Periodic inspections and maintenance would be performed to ensure the integrity of the landfill cover.

8.5 Alternative 3: Containment with Single Barrier Cover

Alternative 3 includes the same components as Alternative 2 except that the soil cover would consist of a single barrier cover composed of a 12 inch layer of compacted native soil, a 24 inch clay layer, and at least a 24 inch protective layer of vegetation and native soil. Conventional construction equipment would be used to cap the landfill. Native vegetation would be planted to stabilize the soil surface, promote evapotranspiration, and decrease erosion of the soil cover.

9. SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

Each remedial alternative must be compared according to nine evaluation criteria that serve as a basis for conducting the analysis of alternatives, and for subsequently selecting an appropriate remedial action. The evaluation criteria are divided into three categories: (1) threshold criteria that relate directly to statutory findings and must be satisfied by the chosen alternative; (2) primary balancing criteria that include long and short term effectiveness, implementability, reduction of toxicity, mobility, and volume, and cost; and (3) modifiying criteria that measure the acceptability of the alternatives to State agencies and the community. The following sections summarize the evaluation of each remedial alternative according to these criteria.

9.1 Threshold Criteria

The remedial alternatives were evaluated in relation to the threshold criteria: overall protection of human health and the environment, and compliance with ARARs. The theshold criteria must be met by the remedial alternatives to be considered as potential remedies.

9.1.1 Overall Protection of Human Health

The remedial alternatives for the Landfill Units were assessed to determine whether they protect human health and the environment. Protection is determined by assessing whether the risks associated with each exposure pathway are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

Alternative 1, the No Action Alternative, would not satisfy the criterion of overall protection of human health and the environment. Alternative 2, Containment with Native Soil Cover, and Alternative 3, Containment with Single Barrier Cover, satisfy the criterion to the degree that both alternatives protect human health by potentially reducing the level of contaminant migration to the ground water and the release of contaminants to the atmosphere. The amount of reduction under Alternatives 2 and 3 is unclear because the potential migration of contaminants may be affected by factors other than moisture infiltration at the surface of the landfill.

9.1.2 Compliance with ARARs

The selected remedial action must comply with identified substantive applicable requirements under Federal and State laws. Remedial actions must also comply with laws and regulations that are not directly applicable, but do pertain to situations sufficiently similar to those encountered at the site, so that use of the requirements is well suited to the site. Determining compliance with ARARs requires evaluation of the remedial alternatives for compliance with chemical, location, and action-specific ARARs.

The ARARs for Alternatives 2 and 3 are identified in Tables 11-1 and 11-2. Both Alternatives meet the identified ARARs through engineering controls and operating procedures. The No Action alternative for the landfills is for comparative purposes only, and does not comply with ARARs.

9.2 Balancing Criteria

Each alternative that satisfies the threshold criteria is evaluated against the five balancing criteria. The balancing criteria include: (1) long-term effectiveness and permanence; (2) reduction of toxicity, mobility, or volume through treatment; (3) short-term effectiveness; (4) implementability; and (5) cost.

9.2.1 Long-Term Effectiveness and Permanence

This criterion evaluates the long-term effectiveness of the alternatives in maintaining protection of human health and the environment.

Alternatives 2 and 3 prevent direct contact with contaminated soils, and would reduce the migration of contaminants from soils and landfill contents to the ground water. The alternatives do not, however, provide permanent treatment. The covers provided under both alternatives would be equally effective in the long-term with proper maintenance, monitoring, and land use restrictions. The No Action Alternative provides the lowest level of long-term effectiveness and permanence because it does not provide recovery or measures to reduce the migration of contaminants to the ground water.

9.2.2 Reduction of Toxicity, Mobility, or Volume Through Treatment

This criterion addresses the statutory preference for selecting remedial actions that use treatment technologies that permanently reduce toxicity, mobility, or volume of the hazardous substances.

Alternatives 2 and 3 reduce the mobility of contaminants by restricting infiltration of surface water through the landfills. The alternatives do not, however, reduce either the toxicity or volume of contaminated soils, or treat any of the contaminants. The No Action Alternative provides no reduction in toxicity, mobility, or volume of the contaminants in the landfill units.

9.2.3 Short-Term Effectiveness

Short-term effectiveness addresses the effects of each alternative during its construction and implementation phase until remedial action objectives are met. The alternatives are evaluated with respect to their effects on human health and the environment during implementation of the alternative.

Both Alternative 2 and Alternative 3 will require a significant level of construction activites to install a cover over the landfill units. Alternative 2 would require less onsite activity than Alternative 3 and therefore, provides greater short-term effectiveness. The No Action Alternative ranks the highest under this criterion because it requires no additional onsite activities, and does not result in additional hazards to human health or the environment.

9.2.4 Implementability

The following three factors must be evaluated under the implementability criterion: (1) technical feasibility; (2) administrative feasibility; and (3) the availability of services and materials.

Alternatives 2 and 3 are both highly implementable because they use established techniques and materials. Alternative 2 is considered more implementable because there is less construction activity and soils may be available locally.

9.2.5 Cost

Evaluation of project costs requires an estimation of the net present value of capital costs and operation and maintenance costs. The costs presented are estimates. Actual costs could vary based on the final design and detailed cost itemization. Table 9-1 presents the cost estimates for each Alternative.

Table 9-1 Cost Estimate for Alternatives for Landfill Units

Alternative	Sample Collection and O & M ($)	Deed Restrictions[1] ($)	Monitoring Well Installation[1] ($)	Excavation and Capping[1] ($)	Total Cost[4] ($)
Alternative 1	NA	NA	NA	NA	0
Alternative 2	21,400[2] 379,000[3]	12,000	800,000	813,800	2,004,800
Alternative 3	21,400[2] 379,000[3]	12,000	800,000	6,325,000	7,516,000

NA Not Applicable

1 These are one time only costs to conduct the work in 1994 and would not have to be amortized.

2 These costs are costs associated for 1994 only, time value of money equations are used to determine 30 year cost.

3 This is the life cycle cost for 30 years of operation and 5% discount rate.

[4] The total cost is an upper-limit cost estimate. The actual costs are expected to be less than these values, and will be determined during the Remedial Design/Remedial Action (RD/RA) phase.

9.3 Modifying Criteria

The modifying criteria are used in the final evaluation of remedial alternatives. The two modifying criteria are state and community acceptance. For both of these criteria, the factors that are considered include the elements of the alternatives that are supported, the elements of the alternatives that are not supported, and the elements of the alternatives that have strong opposition.

9.3.1 State Acceptance

The IDHW concurs with the selected remedial alternative for the Landfill Units as described in Section 10.0. The IDHW has been involved in the development and review of the RI/FS report, the Proposed Plan, this ROD, and other project activities such as public meetings. Comments received from IDHW were incorporated into these documents, which have been issued with IDHW concurrence.

9.3.2 Community Acceptance

This assessment evaluates the general community response to the proposed alternatives presented in the Proposed Plan. Specific comments are addressed in the Responsiveness Summary (Appendix A) of this document.

10. SELECTED REMEDY

The results of the investigations of OU 8-05-1, 8-05-51, and 8-06-53 show that these sites are not fully characterized, and that some future unacceptable risk may exist due to the migration of potential contaminants from the landfills to the Snake River Plain Aquifer, and from intrusion into the landfill contents. The selected remedy for these Operable Units will include the installation of a native soil cover designed to incorporate erosion control measures to reduce the effects from rain and wind. The selected remedy provides for maintenance of the landfill covers, including subsidence correction and erosion control. Monitoring of the landfills will include sampling of soil gas to assess the effectiveness of the cover, and sampling the ground water to evaluate these areas and other areas at NRF using risk-based concentrations. The Agencies will continue to review this action within five years and at least every five years thereafter. Institutional controls (access/land use restrictions, controlling public access, posting signs, and erecting and maintaining barriers) will be implemented to prevent direct exposure to the landfill contents. Short-term risks will be evaluated and minimized during implementation of the selected remedy.

The selected remedy provides a barrier against direct contact, restrictions on access and land use, and early detection of potential contaminant migration.

The remediation goals for the landfill areas were developed in accordance with the RI/FS CERCLA Landfill Guidance (EPA 1991). These goals include preventing direct contact with landfill contents, and meeting all ARARs.

11. STATUTORY DETERMINATION

Remedy selection is based on CERCLA, as amended by SARA, and the regulations contained in the NCP. All remedies must meet the threshold criteria established in the NCP: protection of human health and the environment, and compliance with ARARs. CERCLA also requires that the remedy use permanent solutions and alternative treatment technologies to the maximum extent practicable, and that the implemented action must be cost-effective. Finally, the statute includes a preference for remedies that employ treatment that permanently and significantly reduce the volume, toxicity, or mobility of hazardous wastes as their principal element. The following sections discuss how the selected remedy meets these statutory requirements.

11.1 Protection of Human Health and the Environment

As described in Section 10, the selected remedy satisfies the criterion of overall protection of human health and the environment by minimizing the risk of potential contaminant migration to ground water and by preventing direct contact with the landfill waste materials. The remedy will ensure that cumulative risks are maintained within the NCP risk range.

11.2 Compliance with ARARs

The selected remedy of containment with a native soil cover with vegetation will be designed to meet all ARARs of Federal and State regulations. The ARARs that will be achieved by the selected alternative are described in Sections 11.2.1 and 11.2.2.

11.2.1 Chemical-Specific

No chemical-specific ARARs are identified for the selected remedy.

The future concentrations of inorganic contaminants in the ground water are predicted to be below the risk-based concentrations as determined by the GWSCREEN modeling program. However, due to the uncertainty regarding the source term (regarding both organic and inorganic constituents), long-term monitoring of the ground water and landfill soil gas would provide early indications if migration of contaminants occurs. The soil over the landfills does not exceed any known soil contamination standards.

11.2.2 Action-Specific

The selected remedy triggers the applicable or relevant and appropriate action-specific requirements listed in Table 11-1. Although 40 CFR 258 is also appropriate for the Landfill Units, the more rigorous requirements for Hazardous Waste Management Units were selected in this instance due to the uncertainty in the types of wastes disposed.

11.2.3 Location-Specific

The selected remedy will trigger ARARs under the Archeological Resources Protection Act, Archeological and Historic Preservation Act, and Preservation of American Antiquities Act. These acts are applicable to the remedy since the cultural resources must be protected if additional native soil from another site is needed for the installation of caps on the landfills. Table 11-2 provides a description of the pertinent ARARs.

Table 11-1 Federal and State Action-Specific ARARS for Landfill Units		
Regulation	Title	Category
40 CFR 264.310 (RCRA Subtitle C)	Closure and Post-Closure Care	Relevant and Appropriate
IDAPA 16.01.05.008	Closure and Post-Closure Care	Relevant and Appropriate
IDAPA 16.01.01.650 - 01651	Rules for Control of Fugitive Dust and General Rules	Applicable

Table 11-2 Federal and State Location-Specific ARARS for Landfill Units		
Regulation	Title	Category
36 CFR 800	Protection of Historic and Cultural Properties	Applicable
43 CFR 7	Protection of Archeological Resources	Applicable

11.2.4 To-be-Considered Guidance

In implementing the selected remedy, the agencies have agreed to consider a number of procedures or guidance documents that are not legally binding. The following list of documents are to be considered as guidance documents:

- OSWER 9234.2-04FS, October 1989, "RCRA ARARs: Focus on Closure Requirements";
- OSWER 9476.00-1, September 1982, "Evaluating Cover Systems for Solid and Hazardous Waste" (Revised).

These OSWER directives provide additional guidance on the design specifications for constructing and maintaining a cover system.

11.3 Cost Effectiveness

The selected remedial action is cost effective because it is protective of human health and the environment, achieves ARARS, and its effectiveness in meeting the remedial objectives is proportional to its costs.

11.4 Use of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable

The selected remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a cost-effective manner. In accordance with the EPA's Presumptive Remedy for CERCLA Municipal Landfill Sites, the selected remedy provides protection by minimizing the risk of contaminant migration to the aquifer and limiting access to the landfill contents. Presumptive remedies, such as the containment remedy selected for the landfill units, are based on historical patterns of remedy selection and scientific and engineering evaluation of performance data on technology implementation at similar sites.

Implementation of the selected cover remedy will reduce the mobility of hazardous substances, polllutants, and contaminants from the landfill units to the aquifer. The selected cover remedy does not employ alternative treatment or resource recovery technologies. The use of alternative treatment technologies was determined to be impracticable due to the availability and applicability of a presumptive remedy.

11.5 Preference for Treatment as a Principal Element

The statutory preference for remedies that employ treatment as a principal element will not be met. Extraction and treatment of the landfill contents is not considered a cost effective means of reducing the risks to human health and the environment. The identified risks will be reduced to acceptable levels by implementing the presumptive remedy. That remedy, which includes containment, monitoring, and land use controls, is based on historical patterns of effective risk reduction.

12. DOCUMENTATION OF SIGNIFICANT CHANGES

No significant changes have been made from the recommendations presented in the Proposed Plan.

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